

EXHIBIT B

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MINNESOTA**

3M Innovative Properties Company and 3M)	
Company,)	
)	Civil Action No.: 07 c.v. 4625 (DWF/AJB)
Plaintiffs,)	
)	
vs.)	Jury Trial Demanded
)	
United States Gypsum Company,)	
)	
Defendant)	

AMENDED COMPLAINT

Plaintiffs 3M Innovative Properties Company and 3M Company (collectively “3M”) for their complaint against Defendant United States Gypsum Company (“USG”), state and allege as follows:

NATURE OF THE ACTION

1. This is an action for willful patent infringement arising under the patent laws of the United States, including 35 U.S.C. §§ 271, §§ 281-285 and §§ 291.
2. Plaintiff 3M Innovative Properties Company is the owner, by assignment, of United States Patent No. 7,052,544 B2 (the “‘544 Patent”) entitled “Low Dust Wall Repair Compound.” A true and correct copy of the ‘544 Patent is attached as Exhibit A. Plaintiff 3M Company is the exclusive licensee of the ‘544 Patent and has standing to bring suit enforcing the ‘544 Patent. As set forth below, USG has infringed and continues to infringe the ‘544 Patent.
3. This action also seeks adjudication of the validity of USG’s interfering United States Patent No. 6,673,144 (the “USG Patent”) pursuant to 35 U.S.C. § 291.

4. This is also an action for breach of contracts governed by the Laws of the State of Minnesota. As set forth the below, USG has repeatedly breached its obligations under Confidential Disclosure Agreements with 3M relating to 3M's low dust wall repair compound technology.

PARTIES

5. 3M Innovative Properties Company is a corporation organized and existing under the laws of the State of Delaware, with its principal place of business located at 3M Center, St. Paul, Minnesota.

6. 3M Company is a corporation organized and existing under the laws of the State of Delaware, with its principal place of business located at 3M Center, St. Paul, Minnesota. 3M Company is a global, diversified manufacturing company. 3M Company develops, manufactures, and sells tens of thousands of innovative products across a wide range of industries, including the architectural and building products industry.

7. Upon information and belief, USG is a corporation organized under the laws of the State of Delaware, with its principal place of business located at 550 West Adams Street, Chicago, Illinois. USG manufactures, sells, and offers to sell its infringing *Sheetrock® Brand Lightweight All Purpose Joint Compound Ready Mixed Plus 3 with Dust Control* (the "USG Dust Control Compound") throughout the United States. USG has sold and offered to sell the USG Dust Control Compound in Minnesota.

JURISDICTION AND VENUE

8. This Court has subject matter jurisdiction over Counts I and II of this matter pursuant to 28 U.S.C. §§ 1331 and 1338(a).

9. The Court has supplemental jurisdiction over the remaining Counts asserted herein under 28 U.S.C. §1367(a).

10. This Court has personal jurisdiction over USG because, *inter alia*: (1) USG, on information and belief, does business throughout the United States, including in this judicial district; (2) under the Minnesota Long Arm Statute, Minn. Stat. § 543.19, USG, on information and belief, transacts business in Minnesota and/or has committed acts of patent infringement within and/or outside Minnesota that have caused injury in Minnesota; and (3) as set forth below, USG has expressly consented to personal jurisdiction in this judicial district.

11. Venue is proper in this District pursuant to 28 U.S.C. § 1391(b) and (c) and § 1400(b). Venue is also proper in this District because, as detailed below, the parties entered a binding contractual agreement that any dispute arising from the subject matter set forth herein “shall be brought solely and exclusively in the United States District Court for the District of Minnesota.”

FACTUAL BACKGROUND

3M’s Pioneering Low Dust Wall Compound Technology:

12. 3M Innovative Properties Company owns a portfolio of six issued United States patents, including the ‘544 Patent, and several additional pending patent applications, all relating to low dust wall repair compounds and their methods of use. Each of these patents and pending applications claim priority to a single pioneering patent application filed on behalf of inventor Nathaniel P. Langford on December 10, 1998.

13. Prior to Mr. Langford’s inventions, generations of inventors and members of the construction trade had sought to address the problems associated with dust generated by sanding wall repair compounds.

14. Efforts to address these problems have included modifications to sanders and other equipment used in the sanding operation. For example, one approach was to attach a vacuum cleaner to the sanding head for collecting the dust. Another approach used a wet sponge to prevent the formation of airborne dust.

15. Mr. Langford's inventions took a completely different approach. Mr. Langford conceived that the composition of the joint compound itself could be altered to achieve a reduction in the amount of dust generated during sanding. He further conceived that certain additives, when added in a suitable amount to a joint compound, would reduce the amount of dust generated by the compound during sanding.

16. On March 2, 2002 USG filed a patent application titled "Joint Compound Providing Low Dusting and Good Gloss Retention." This application named Salvatore C. Immordino, Jr. as one of two 'inventors.' On January 6, 2004, this patent application issues as U.S. Patent No. 6,674,144 (the "USG Patent").

17. On January 5, 2005, 3M filed the patent application that ultimately issued as the '544 Patent. This application claimed the benefit of the filing date of 3M's original 1998 application discussed above. On May 30, 2006, the United States Patent and Trademark Office duly issued the '544 Patent.

18. Since at least May 30, 2006, USG has continued to manufacture, sell and offer to sell its infringing USG Low Dust Compound throughout the United States without license from 3M.

19. Effective February 1, 2001, 3M and USG entered into a Confidential Disclosure Agreement (the "February 1, 2001 CDA"). Pursuant to the February 1, 2001 CDA, 3M disclosed to USG certain confidential information defined by the parties to include "business and

technical information relating to a low-dust drywall compound . . .” A true and correct copy of the February 1, 2001 CDA is attached as Exhibit B.

3M's Disclosure Of Its Technology To USG:

20. Under the February 1, 2001 CDA, USG agreed that it would “use the Information only for the purpose of working with [3M] in connection with possible licensing of technology.”

21. USG expressly agreed that it would “not disclose Information to a third party without express written permission from [3M].”

22. USG further agreed that it would “protect the disclosed Information by using the same degree of care, but no less than a reasonable degree of care, to prevent the unauthorized disclosure of the Information, as [USG] uses to protect its own confidential information of a like nature.”

23. USG’s obligations under the February 1, 2001 CDA continued in effect through and including February 1, 2004.

24. In reliance upon USG’s obligations under the February 1, 2001 CDA, 3M disclosed to USG confidential and proprietary business and technical information relating to its low dust wall repair compound.

25. For example, on February 27, 2001, representatives of 3M met with representatives of USG, including Salvatore C. Immordino, Jr., for the purpose of demonstrating the performance of 3M’s confidential and proprietary low dust wall repair compound compared to USG’s *Sheetrock® Brand Ready Mix Lightweight Joint Compound Plus 3*.

26. At this meeting, 3M also disclosed confidential and proprietary information regarding the market for 3M’s low dust wall repair compound.

27. USG's representatives indicated that they were impressed with both the performance of 3M's confidential and proprietary low dust wall repair compound and the related market information provided by 3M.

28. USG further indicated that it was interested in licensing 3M's low dust wall repair compound technology.

29. Following this meeting and pursuant to USG's request, 3M provided USG with two five-gallon samples of 3M's confidential and proprietary low dust wall repair compound for evaluation by USG.

30. In a written evaluation completed by Mr. Immordino, USG observed that the low dust wall repair compound samples provided by 3M "had superior low dusting properties compared to the Plus 3 formulation" commercially available from USG.

31. On information and belief, "Sam" Immordino is the same person as Salvatore C. Immordino, Jr.

USG's Offer To License And Decision To Proceed With Unlicensed Manufacture:

32. Following its evaluation of the samples 3M provided pursuant to the February 1, 2001 CDA, USG sought to license 3M's low dust wall repair compound technology. 3M rejected the royalty terms proposed by USG and the parties discontinued their licensing discussions.

33. In June 2005, 3M learned that USG had begun to manufacture and sell the USG Dust Control Compound. Shortly thereafter, 3M re-initiated contact with USG, and once again offered to license its low dust wall repair compound technology to USG, including the pending application that ultimately issued as the '544 Patent.

34. USG indicated that it was interested in such a licensing relationship, and was taking into serious consideration 3M's renewed offer to license its low dust wall repair compound technology.

35. To facilitate such continued discussion, the parties entered into a second Confidential Disclosure Agreement, effective January 1, 2006 (the "January 1, 2006 CDA"). The January 1, 2006 CDA expressly referenced the '544 Patent. The parties further acknowledged that the purpose of the January 1, 2006 CDA was to allow the parties "to confer regarding the subject matter of the USG patent and the 3M ['544] patent and other confidential proprietary information owned by USG and/or 3M." A true and correct copy of the January 1, 2006 CDA is attached as Exhibit C.

36. Pursuant to the terms of this January 1, 2006, CDA, 3M disclosed to USG certain confidential information defined by the parties to include "3M's general business and financial information relating to low dust drywall joint compounds, and information relating to 3M's patent portfolio for low dust drywall joint compounds. . ."

37. Pursuant to the January 1, 2006 CDA, USG agreed that it would not disclose 3M's confidential information to a third party without express written authorization from 3M. USG further agreed that it would not use 3M's confidential information "for purposes of manufacture or procurement of the product to which the information pertains."

38. Pursuant to the January 1, 2006 CDA, 3M and USG further agreed "that any dispute arising from the subject matter of this . . . Agreement shall be brought solely and exclusively in the United States District Court for the District of Minnesota."

COUNT I - PATENT INFRINGEMENT

39. 3M restates and realleges each of the assertions set forth in Paragraphs 1 through 38 above.

40. USG has made, sold, and offered to sell, in this judicial district and elsewhere in the United States, the USG Low Dust Compound that infringes the '544 Patent.

41. The infringement by USG of the '544 Patent has injured 3M, and will cause 3M further irreparable injury and damage in the future unless USG is enjoined from infringing said patent.

42. USG had actual knowledge of the '544 Patent, and has willfully, deliberately and intentionally infringed the claims of said patent.

COUNT II – CANCELLATION OF THE USG PATENT PURSUANT TO 36 U.S.C. § 291

43. 3M restates and realleges each of the assertions set forth in Paragraphs 1 through 42 above.

44. The USG Patent is invalid under 35 U.S.C. §§ 102 and 103, in light of *inter alia*, the '544 Patent.

45. 3M has priority of invention of the claimed inventions in the '544 Patent and USG Patent.

46. 3M is entitled to an order pursuant to 35 U.S.C. § 291, adjudging the validity of the USG Patent, adjudging the priority of invention of the claimed inventions, and canceling the USG Patent.

COUNT III – BREACH OF THE FEBRUARY 1, 2001 CDA

47. 3M restates and realleges each of the assertions set forth in Paragraphs 1 through 46 above.

48. The February 1, 2001 CDA was a binding and valid contractual agreement between 3M and USG.

49. 3M has fully complied with all of its obligations under the February 1, 2001 CDA.

50. Under the February 1, 2001 CDA, USG agreed that it would “use the Information only for the purpose of working with [3M] in connection with possible licensing of technology.” USG expressly agreed that it would “not disclose Information to a third party without express written permission from [3M].” USG further agreed that it would “protect the disclosed Information by using the same degree of care, but no less than a reasonable degree of care, to prevent the unauthorized disclosure of the Information, as [USG] uses to protect its own confidential information of a like nature.” USG has failed to meet these obligations.

51. On information and belief, USG has breached its obligations under the February 1, 2001 CDA. Such breaches include: (1) disclosing 3M’s confidential information relating to a low-dust wall repair compound in connection with its attempts to secure the USG Patent; and (2) using such confidential information for purposes unrelated to working with 3M in connection with possible licensing of 3M’s technology.

52. 3M has suffered and will continue to suffer both irreparable injury and actual damages, in an amount to be determined at trial, as a result of USG’s breaches of the February 1, 2001 CDA.

COUNT IV – BREACH OF THE JANUARY 1, 2006 CDA

53. 3M restates and realleges each of the assertions set forth in Paragraphs 1 through 52 above.

54. The January 1, 2006 CDA is a binding and valid contractual agreement between 3M and USG.

55. 3M has fully complied with all of its obligations under the January 1, 2006 CDA.

56. On information and belief, USG has breached its obligations under the January 1, 2006 CDA. Such breaches include filing an action in the United States District Court for the Northern District of Illinois, titled *United States Gypsum Company v. 3M Innovative Products Company, et al.*, (Court File No. 07cv6381) (the “Illinois Action”), by which USG purports to seek declaratory and other relief relating to the ’544 Patent.

57. 3M has suffered and will continue to suffer both irreparable injury and actual damages, in an amount to be determined at trial, as a result of USG’s breaches of the January 1, 2006 CDA.

COUNT V – UNJUST ENRICHMENT

58. 3M restates and realleges each of the assertions set forth in Paragraphs 1 through 57 above.

59. Upon information and belief, USG has derived benefits from the invention claimed in the USG Patent which actually belongs to 3M.

60. It would be unjust for USG to retain such benefits which properly belong to 3M.

61. 3M is entitled to an award of those benefits unjustly derived from the invention claimed in the USG Patent, and the value of any such benefits should be disgorged to 3M.

JURY TRIAL DEMANDED

62. A jury trial is demanded on all issues so triable, pursuant to Rule 38 of the Federal Rules of Civil Procedure.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs 3M Innovative Properties Company and 3M Company (collectively "3M") pray for entry of judgment against Defendant United States Gypsum Company ("USG") as follows:

- a. Finding that USG has infringed the '544 Patent;
- b. Enjoining USG and its agents, servants, officers, directors, employees, affiliated entities, and all persons acting in concert with them, from continuing infringement of the '544 Patent;
- c. Ordering USG to account for and pay to 3M the damages to which 3M is entitled as a consequence of the infringement of the '544 Patent;
- d. Ordering that such damages be trebled for the willful, deliberate and intentional infringement by USG as alleged herein in accordance with 35 U.S.C. § 284;
- e. Finding this case to be "exceptional" and awarding 3M its costs and attorneys' fees herein in accordance with 35 U.S.C. § 285;
- f. Adjudging the validity of the USG Patent, granting priority of invention to 3M and directing the United States Patent and Trademark Office to cancel the USG Patent, pursuant to 35 U.S.C. § 291;
- g. Finding that USG has materially breached its obligations under the February 1, 2001 CDA;
- h. Enjoining USG and its agents, servants, officers, directors, employees, affiliated entities, and all persons acting in concert with them, from continuing breaches of the February 1, 2001 CDA;
- i. Ordering USG to pay to 3M the damages to which 3M is entitled as a consequence of USG's breaches of the February 1, 2001 CDA;

- j. Finding that USG has materially breached its obligations under the January 1, 2006 CDA;
- k. Enjoining USG and its agents, servants, officers, directors, employees, affiliated entities, and all persons acting in concert with them, from continuing breaches of the January 2, 2006 CDA, including without limitation enjoining USG from proceeding with the Illinois Action;
- l. Ordering USG to pay to 3M the damages to which 3M is entitled as a consequence of USG's breaches of the January 1, 2006 CDA; and
- m. Awarding to 3M the value of all benefits unjustly derived by USG from the invention claimed in the USG Patent;
- n. Awarding prejudgment and post-judgment interest on all sums awarded;
- o. Awarding 3M its costs as allowed by law; and
- p. Granting such other and further relief as the Court may deem just and equitable.

DEMAND FOR JURY TRIAL

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, 3M respectfully requests a trial by jury of any and all issues on which a trial by jury is available under applicable law.

ROBINS, KAPLAN, MILLER & CIRESI, LLP

Date: November 28, 2007

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ATTORNEYS FOR PLAINTIFFS 3M

***INNOVATIVE PROPERTIES COMPANY AND
3M COMPANY***

EXHIBIT A



US007052544B2

(12) **United States Patent**
Langford

(10) **Patent No.:** **US 7,052,544 B2**
(45) **Date of Patent:** **May 30, 2006**

(54) **LOW DUST WALL REPAIR COMPOUND**

(75) **Inventor:** Nathaniel P. Langford, Somerset, WI (US)

(73) **Assignee:** 3M Innovative Properties Company, St. Paul, MN (US)

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** 11/029,759

(22) **Filed:** Jan. 5, 2005

(65) **Prior Publication Data**

US 2005/0119388 A1 Jun. 2, 2005

Related U.S. Application Data

(60) Division of application No. 10/788,053, filed on Feb. 26, 2004, now Pat. No. 6,863,723, which is a division of application No. 09/821,392, filed on Mar. 29, 2001, now Pat. No. 6,733,581, which is a continuation-in-part of application No. 09/208,782, filed on Dec. 10, 1998, now Pat. No. 6,358,309.

(51) **Int. Cl.**

C04B 111/72 (2006.01)
C04B 26/02 (2006.01)
C04B 26/04 (2006.01)
C04B 28/14 (2006.01)
C04B 103/00 (2006.01)

(52) **U.S. Cl.** 106/778; 106/270; 106/272; 106/660; 106/780; 106/802; 106/804; 106/817; 106/822; 524/8; 524/423; 524/425

(58) **Field of Classification Search** 106/778, 106/270, 272, 660, 780, 802, 804, 817, 822; 524/8, 423, 425

See application file for complete search history.

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Primary Examiner—Kelechi C. Ekwim

(74) *Attorney, Agent, or Firm*—David B. Patchett,

(57) **ABSTRACT**

A wall repair compound useful for filling and repairing cracks, holes, and other imperfections in a wall surface includes a conventional filler material, a conventional binder material, and a dust reducing additive which reduces the quantity of airborne dust particles generated when sanding the hardened joint compound. Airborne dust reducing additives include oils, surfactants, solvents, waxes, and other petroleum derivatives. The additive can be added to conventional ready-mixed joint compounds and to setting type joint compounds. A method of reducing the quantity of airborne dust generated when sanding a fully hardened joint compound includes mixing a sufficient quantity of the dust reducing additive with the joint compound prior to when the joint compound has been applied to the wall.

11 Claims, 1 Drawing Sheet

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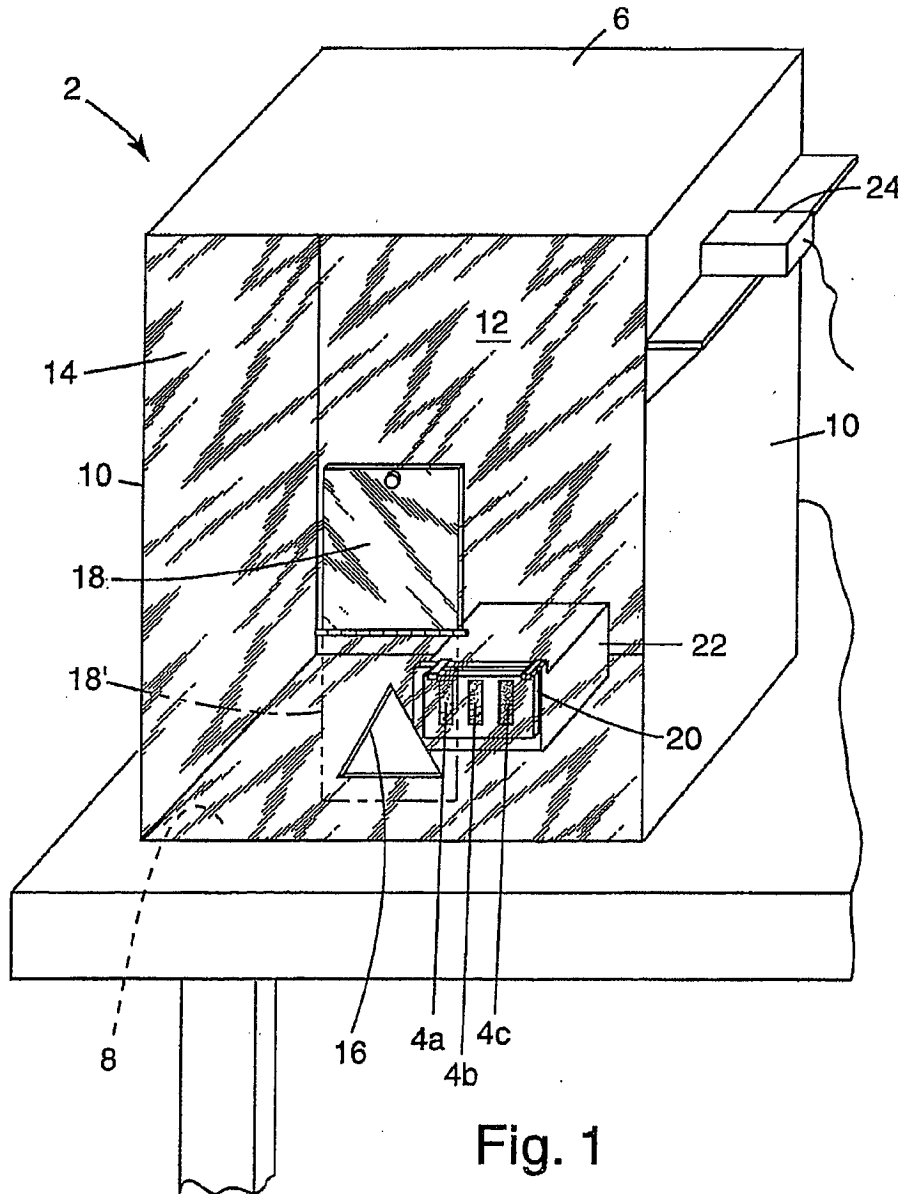
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U.S. Patent

May 30, 2006

US 7,052,544 B2



US 7,052,544 B2

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LOW DUST WALL REPAIR COMPOUND

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a divisional of U.S. application Ser. No. 10/788,053, filed Feb. 26, 2004, now U.S. Pat. No. 6,863,723 which is a divisional of U.S. application Ser. No. 09/821,392, filed Mar. 29, 2001, issued as U.S. Pat. No. 6,733,581, which is a continuation-in-part of U.S. application Ser. No. 09/208,782, filed Dec. 10, 1998, issued as U.S. Pat. No. 6,358,309.

FIELD OF THE INVENTION

The present invention relates generally to wall repair compounds such as joint compounds, spackling compounds, and the like used to repair imperfections in walls or fill joints between adjacent wallboard panels. More particularly, the present invention relates to such a wall repair compound that includes an additive which reduces the quantity of airborne dust generated when the hardened compound is sanded.

BACKGROUND OF THE INVENTION

Interior walls of residential and commercial buildings are often constructed using gypsum wallboard panels, often referred to simply as "wallboard" or "drywall." The wallboard panels are attached to studs using nails or other fasteners, and the joints between adjacent wallboard panels are filled using a specially formulated adhesive composition called joint compound to conceal the joints. The procedure for concealing the joint between adjacent wallboards, and thereby producing a smooth seamless wall surface, typically includes applying soft wet joint compound within the joint or seam formed by the abutting edges of adjacent wallboard panels using a trowel or the like. A fiberglass, cloth, or paper reinforcing tape material is then embedded within the wet joint compound, and the compound is allowed to harden. After the joint compound has hardened, a second layer of joint compound is applied over the joint and tape to completely fill the joint and provide a smooth surface. This layer is also allowed to harden. Upon hardening, the joint compound is sanded smooth to eliminate surface irregularities. Paint or a wall covering, such as wall paper, can then be applied over the joint compound so that the joint and the drywall compound are imperceptible under the paint or wall covering. The same joint compound can also be used to conceal defects caused by the nails or screws used to affix the wallboard panels to the studs, or to repair other imperfections in the wallboard panels, so as to impart a continuously smooth appearance to the wall surface.

Various drywall joint compounds are known for concealing joints between adjacent wallboard panels. Conventional joint compounds typically include a filler material and a binder. Conventional fillers are calcium carbonate and calcium sulfate dihydrate (gypsum), which are used in "ready mixed" joint compounds, and calcium sulfate hemihydrate ($\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$), also referred to as plaster of Paris or calcined gypsum, which is used in "setting type" joint compounds. Ready mixed joint compounds, which are also referred to as pre-mixed or drying type joint compounds, are pre-mixed with water during manufacturing and require little or no addition of water at the job site. Such joint compounds harden when the water evaporates and the compound dries. Setting type joint compounds, on the other hand, harden upon being mixed with water, thereby causing

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dihydrate crystals to form and interlock. Setting type joint compounds are therefore typically supplied to the job site in the form of a dry powder to which the user then adds a sufficient amount of water to give the compound a suitable consistency.

The Koltisko, Jr. et al. U.S. Pat. No. 4,972,013 provides an example of a ready-mixed (wet) joint compound including a filler, binder, thickener, non-leveling agent, and water. The McInnis U.S. Pat. No. 5,277,712 provides an example of a setting (dry mix-type) joint compound including a fine plaster material, such as stucco, a material which imparts internal strength and workability to the joint compound, such as methyl cellulose, and a material for retaining water, such as perlite. Additional examples of joint compounds are provided in the Brown U.S. Pat. No. 4,294,622; the Mudd U.S. Pat. No. 4,370,167; the Williams U.S. Pat. No. 4,454,267; the Struss et al. U.S. Pat. No. 4,686,253; the Attard et al. U.S. Pat. No. 5,336,318; and the Patel U.S. Pat. No. 5,779,786.

A spackling compound is disclosed in the Deer et al. U.S. Pat. No. 4,391,647. While joint compound and spackling compound do many of the same things and are both smeared onto walls to hide flaws, spackling compound is generally lighter, dries more quickly, sands more easily, and is more expensive than joint compound. For simplicity, joint compound, drywall joint compound, and like expressions are used throughout this specification to refer to wall repair compounds generally, including joint compound and spackling compound.

Sanding hardened joint compound can be accomplished using conventional techniques including power sanders, abrasive screens, or manual sanders which consist simply of a supporting block and a piece of abrasive paper mounted on the block. Sanding the joint compound, however, produces a large quantity of an extremely fine powder which tends to become suspended in air for a long period of time. The airborne particles settle on everything in the vicinity of the sanding site and usually require several cleanings before they can all be collected, thereby making cleanup a time consuming and tedious process. The particles may also present a serious health hazard to the worker.

The airborne particles are highly pervasive and can enter the nose, lungs, eyes and even the pores of the skin. Results from a study conducted by the National Institute for Occupational Safety and Health found that dust levels in 9 out of 10 test samples taken at test sites where workers were finishing drywall with joint compound were higher than the limits set by OSHA. The report also said that the dust may not be safe even when it falls within the recommended limits. In addition, the study found that several dust samples contained silica and kaolin, a material found in clay, which have been found to cause permanent lung damage. The report recommended the use of local exhaust ventilation, wet finishing techniques, and personal protective equipment to reduce the hazard.

In an effort to reduce the dust generation and cleanup problems associated with the sanding of conventional joint compounds, various attempts have been made to develop specialized dustless drywall sanders. The Matechuk U.S. Pat. No. 4,782,632, for example, discloses a drywall sander including a sanding head designed to minimize the release of dust and further discloses attaching a vacuum cleaner to the sanding head to collect the dust. The Krumholz U.S. Pat. No. 4,955,748 discloses a dustless drywall finisher which uses a wet sponge to prevent the formation of airborne dust.

Dust remains a problem, however, when conventional power sanders or hand sanders are used to sand conventional

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joint compounds. A need therefore exists for a joint compound that can be sanded using conventional sanders without producing a large quantity of fine particles capable of becoming suspended in air. It would also be desirable to provide an additive that could be mixed with commercially available joint compounds to inhibit the formation of airborne particles during the sanding procedure without otherwise interfering with the properties of the joint compound.

SUMMARY OF THE INVENTION

The present invention provides a wall repair compound, such as a joint compound or spackling compound which, when sanded, generates a lower level of airborne particles than conventional joint compounds. More specifically, the present invention provides a wall repair compound which includes a dust reducing additive. Generally, the wall repair or joint compound includes a sufficient amount of the dust reducing additive so that when the joint compound is tested as described in this specification, it generates a lower quantity of airborne dust than the joint compound would produce if it did not contain the dust reducing additive.

The dust reducing additive can be pre-mixed into the wet joint compound prior to application or applied as a coating to the hardened joint compound after application. Generally, the dust reducing additive reduces the quantity of airborne dust particles having a size of less than or equal to 10 microns to less than 50% of the quantity that would be generated without the additive. In certain embodiments, the quantity of airborne dust particles is reduced by at least 75% compared to a mixture without the additive. Most preferably, the level of airborne dust is reduced by more than 90%. In one embodiment, the quantity of airborne particles generated by sanding the hardened joint compound of the present invention was less than 50 mg/m³ and, in certain other embodiments, less than about 15 mg/m³. The quantity of airborne particles generated by sanding the hardened joint compound is preferably less than 5 mg/m³.

It is desirable that the dust reducing additive serve to suppress the formation of airborne particles without significantly interfering with the desired characteristics of the joint compound. Suitable dust reducing additives include oils, such as mineral oils, vegetable oils and animal oils, surfactants, oleoresinous mixtures, pitch, solvents, paraffins, waxes, including natural and synthetic wax, glycols, and other petroleum derivatives. Other materials which do not fit within the above categories may also effectively reduce the quantity of dust generated by a joint compound.

The joint compound formulations include a conventional filler material and a binder material, such as a resin. The joint compound can also include a surfactant, which may or may not serve to suppress airborne dust formation, and a thickening agent. Prior to hardening, the joint compound preferably includes a sufficient amount of water to form a mud-like spreadable material which can be applied to the wall surface. The present invention further provides an additive which can be admixed with conventional joint compounds to reduce the quantity of dust generated during sanding. The dust reducing additive can be used with both drying type (i.e. ready mixed) or setting type joint compounds.

The present invention also provides a method of reducing the quantity of airborne dust generated by sanding a fully hardened joint compound which includes mixing a sufficient quantity of a dust reducing additive with the joint compound prior to applying the joint compound to a wall surface.

It is also desirable that the present invention provide a joint compound having good plasticity, water retention,

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cohesiveness, viscosity stability, resistance to cracking, sandability, minimal shrinkage, good paint adherence, light weight, low cost, good hardening properties, and other properties comparable to those offered by conventional joint compounds.

These and other features and advantages of the invention will be apparent to those skilled in the art when considered in view of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of the testing enclosure used to measure the quantity of airborne dust generated by sanding the wall repair compounds of the present invention.

DETAILED DESCRIPTION

According to the present invention, there are provided compositions suitable for filling and repairing cracks, holes, or other imperfections in a wall surface, such as the joints between adjacent wallboard panels. The compositions of the present invention include a dust reducing additive combined with conventional wall repair compound materials including a filler and a binder to form a low dust wall repair compound. Dust reducing additive refers to any ingredient capable of preventing, minimizing, suppressing, reducing, or inhibiting the formation of particles capable of becoming airborne. The expressions "airborne particles" or "airborne dust particles" refer to fine particles generated during the sanding or abrading of the compound which are capable of being carried by or through the air. Wall repair compound refers generally to compositions useful for filling and repairing cracks, holes, and other imperfections in surfaces such as drywall, wood, plaster, and masonry. Wall repair compounds include interior finishing and patch compounds such as joint compound, spackling compound, wood fillers, plasters, stucco, and the like. The joint compound can also include a thickener, and other materials found in conventional joint compounds.

Any conventional filler material can be used in the present invention. Suitable fillers include calcium carbonate (CaCO₃) and calcium sulfate dihydrate (CaSO₄·2H₂O commonly referred to as gypsum) for ready mixed type joint compounds, and calcium sulfate hemihydrate (CaSO₄·½H₂O) for setting type joint compounds. The joint compound can also include one or more secondary fillers such as glass micro bubbles, mica, perlite, talc, limestone, pyrophyllite, silica, and diatomaceous earth. The filler generally comprises from about 25% to about 95% of the weight of the joint compound based on the total wet weight of the formulation (i.e. including water). More preferably, the filler comprises from about 55% to about 75% of the total wet weight, and most preferably, from about 60% to about 70%.

Another ingredient usually present in joint compounds is a binder or resin. Suitable binders include polyvinyl acetate, polyvinyl alcohol, ethylene vinyl acetate co-polymer, vinylacrylic co-polymer, styrenebutadiene, polyacrylamide, other acrylic polymers, other latex emulsions, natural and synthetic starch, and casein. These binders can be used alone or in combination with one another. The amount of binder can range from about 1% to about 45% of the joint compound total wet weight. More preferably, the binder comprises from about 1% to about 20% of the total wet weight, and most preferably, from about 4% to about 14%. Preferred binders are Rhoplex HG 74M and Rhoplex AC 417M acrylic copolymers available from Rohm and Haas, Philadelphia, Pa.

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A surfactant can also be included in the joint compound formulation, particularly when the dust reducing additive includes an oil. Certain surfactants have also been found to act as dust reducing additives by themselves. A preferred surfactant is Triton X-405, a nonionic surfactant available from Union Carbide Chemicals and Plastics Co. Inc., Danbury, Conn. The surfactant generally comprises less than about 3.5% of the joint compound total wet weight, and preferably less than about 0.25%.

Many joint compound formulations also contain a cellulosic thickener, usually a cellulosic ether. Suitable thickeners include methyl cellulose, hydroxypropyl cellulose, hydroxypropyl methyl cellulose, hydroxyethyl cellulose, hydroxyethyl methyl cellulose, hydroxyethyl hydroxypropyl cellulose, ethylhydroxyethyl cellulose, and sodium carboxymethyl cellulose (CMC). These thickeners can be used alone or in combination with one another. The amount of cellulosic thickener can range from about 0.1% to about 2% by weight of the joint compound. A preferred thickener is hydroxypropyl methyl cellulose available from Dow Chemical Company under the trade designation Methocel.

Another ingredient that can be included in the joint compound of the invention is a non-leveling agent. Suitable non-leveling agents include clays such as attapulgus clay, bentonite, illite, kaolin and sepiolite, and clays mixed with starches. Thickeners, such as those described above, can also function as non-leveling agents.

To provide a lighter weight joint compound, glass bubbles or a specially treated expanded perlite can be added as described in U.S. Pat. No. 4,454,267. Additional ingredients which can be utilized in the joint compound are preservatives, fungicides, anti-freeze, wetting agents, defoamers, flocculents, such as polyacrylamide resin, and plasticizers, such as dipropylene glycol dibenzoate.

In accordance with a characterizing feature of the present invention, the joint compound includes an ingredient which serves to minimize the quantity of airborne particles generated during sanding of the hardened joint compound. The additive generally comprises less than 20% of the joint compound total wet weight. More preferably, the dust reducing additive comprises between about 0.1% and about 10% of the joint compound by wet weight percent and, most preferably, between about 1.5% and about 6%.

Many ingredients have been found to effectively reduce the quantity of airborne particles generated when sanding the joint compound including oils such as animal, vegetable, and mineral oils (saturated and unsaturated), and oils derived from petroleum, pitch, natural and synthetic waxes, paraffins, solvents which evaporate slower than water, terpenes, glycols, surfactants, and mixtures thereof. A preferred dust reducing additive is a mixture of mineral oil and an unsaturated oil, such as corn oil, comprising from about 1.5% to about 6% of the joint compound total wet weight, and a surfactant comprising from about 0.15% to about 0.40% of the joint compound total wet weight. It has also been found that increasing the level of resin in the joint compound may serve to reduce the level of airborne dust generated during sanding.

While the manner by which each additive serves to suppress the formation of particles capable of becoming airborne is not fully understood, some general observations have been made. For example, it was observed that the joint compounds containing a dust reducing additive seemed to produce particles which were larger and heavier than the particles produced by joint compounds without a dust reducing additive. Thus, the dust reducing additive may cause the dust particles to agglomerate or stick together, thereby

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forming large heavy particles which tend not to become or remain airborne. The invention, however, is not intended to be limited to any particular mechanism.

The relative quantity of the various ingredients can vary substantially in accordance with the invention. Table 1 shows the general range of each ingredient for either a setting type joint compound or a ready-mixed type joint compound in its wet condition:

TABLE 1

	Percent by Weight (Wet)
Filler	25-95%
Binder	1-45%
Thickener	<2%
Water	2-45%
Dust Reducing Additive	<20%

Test Procedure

The test procedure for measuring the quantity of airborne particles generated when sanding the hardened joint compound was as follows. First, each test specimen was prepared according to a specific formulation. The specific formulations for the various joint compounds are described more fully below along with the method used to prepare the specimens. The test specimens were approximately five inches long, one and one-half inches wide, and one quarter of an inch thick (5" by 1½" by ¼"). Before sanding, each test specimen was allowed to completely harden for at least twenty four hours at room temperature in an environment where the relative humidity generally ranged from about 25% to about 75%.

Referring to FIG. 1, there is shown the test enclosure 2 that was used to sand the test specimens 4a, 4b, 4c and measure the quantity of airborne dust particles generated. The enclosure 2 was a rectangular box six feet high, four feet wide, and two feet wide (6'x4'x2'). The top 6, bottom 8, side 10, and rear walls 12 of the enclosure 2 were constructed of wood, and the front wall 14 was constructed of transparent Plexiglas. A generally triangular access opening 16 located about one foot above the bottom wall 8 was provided in the front wall 14 to allow the individual conducting the test to insert his or her hand and arm into the enclosure and sand the specimen. The access opening 16 had a base dimension of about 7½ inches and a height of about 8½ inches. A movable cover member 18 was provided to allow the enclosure 2 to be completely sealed when sanding was completed. To sand the specimens 4a, 4b, 4c, the cover 18 was arranged in its up position as shown by the solid lines in FIG. 1. When sanding was completed, the cover 18 was pivoted downwardly to completely cover the access opening 16 as shown in phantom 18'.

As shown, three specimens 4a, 4b, 4c of joint compound were prepared on a section of wallboard 20 and the section of wallboard 20 was clamped to a mounting block 22 arranged within the enclosure 2. When tested, the specimens were located about twelve inches above the bottom wall 8 of the enclosure. Each specimen was tested individually and after each test, the enclosure was cleaned so that the quantity of airborne dust particles measured less than 0.05 mg/m³. A particle counter 24 for measuring the quantity of airborne particles was mounted in the right side wall about forty eight inches above the center of the specimens 4a, 4b, and 4c.

The test specimens were sanded using a model B04552 power palm sander available from Makita Corporation of

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America, Buford, Ga. The sander included a 4½×4 inch pad equipped with a 120 grit mesh sanding screen mounted over a 5×3½×¾ inch open, semi-rigid, non-woven, heavy duty, stripping, backing pad available from Minnesota Mining and Manufacturing Company, St. Paul Minn. Sanding was performed at a sanding speed of approximately 14,000 OPM (orbits per minute) using ordinary sanding pressure. Ordinary sanding pressure is defined as the amount of pressure typically required to sand a hardened joint compound. Sanding pressure, therefore, is the manual pressure typically applied by an ordinary person when sanding a joint compound. It will be recognized that the sanding pressure can vary depending on the hardness of the joint compound. Sanding was continued until the specimen was completely sanded. That is, the entire thickness of the specimen was sanded so that a generally smooth wall surface was produced. Care was taken to ensure that sanding was discontinued before the drywall itself was sanded. The amount of time required to sand each specimen varied depending on the hardness of the joint compound and the sanding pressure.

The quantity of airborne dust particles was measured starting from the time sanding was initiated until several minutes after sanding was discontinued. In general, the level of airborne dust was measured until the level decreased to less than 50% of its peak level. The quantity of airborne dust was measured using a DUSTTRAK™ aerosol monitor model 8520 available from TSI Incorporated, St. Paul, Minn. The particle counter measures the number of particles having a size of less than or equal to 10 microns. In the Examples, the peak or highest level of airborne dust measured during the test is presented.

Ingredients

A summary of the various ingredients used to prepare the joint compounds in each of the Examples is provided below:

Fillers

Calcium Carbonate—Marble Dust available from ECC International, Sylacauga, Ala.
Calcium Sulfate Dihydrate—available from J. T. Baker Chemical Co., Phillipsburg, N.J.
Mica—Mica AMC available from Kraft Chemical Co., Melrose Park, Ill. Mica prevents cracks from forming as the joint compound hardens.
Kaolin—Aldrich Chemical Co., Milwaukee, Wis.
Glass Bubbles—K1 (177 microns—0.14 g/cm³) glass bubbles available from Minnesota Mining and Manufacturing Company, St. Paul, Minn. Glass bubbles improve the sandability of the joint compound and help to form a lighter weight joint compound.

Binders

Rhoplex HG 74M, Rhoplex HG 74P, Rhoplex AC 417M, Rhoplex 2620, and Rhoplex EC-2848—acrylic resins available from Rohm & Haas, Philadelphia, Penn.
Airflex RP-226—vinyl acetate-ethylene copolymer available from Air Products and Chemicals, Inc., Allentown, Penn.

Waxes

Octowax 321—available from Tiarco Chemical Div., Textile Robber & Chemical Co., Dalton, Ga.
Boler 1070—a paraffin wax available from Boler Inc., Wayne Penn.
Carbowax 540—synthetic wax available from Union Carbide Corp., Danbury, Conn.

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Oils

Corn Oil—conventional corn oil. A suitable corn oil is available from Eastman Kodak Co., Rochester, N.Y.
Linoleic Acid—an unsaturated oil, available from Eastman Kodak Co., Rochester, N.Y.
Castor Oil—an unsaturated vegetable oil available from Aldrich Chemical Co., Milwaukee, Wis.
Tung Oil—an unsaturated vegetable oil available from Woodworkers Store, Medina, Minn.
Mineral Oil—Carnation light mineral oil available from Witco Corporation, Sonneborn Division, New York, N.Y.

Surfactants

Surfactants were generally included in the joint compound formulations when the dust reducing additive included an oil to help emulsify the oil and combine it with a water based joint compound. Certain surfactants, however, were found to have a dust reducing effect when used by themselves.

FC 430—a nonionic surfactant available from Minnesota Mining and Manufacturing Company, Industrial Chemicals, St. Paul, Minn.
Triton X-405—a nonionic surfactant (octylphenoxy polyethoxy ethanol) available from Union Carbide Chemicals and Plastics Co. Inc., Danbury, Conn.
Variquat B-200—a cationic surfactant (benzyl trimethyl ammonium chloride 60%) available from Sherex Chemical Co. Inc., Dublin, Ohio.
Steol KS 460—an anionic surfactant (alkyl ether sulfate sodium salt 60%) available from Stephon Chemical Co., Northfield, Ill.
Span 85—a nonionic surfactant (sorbitan trioleate) available from ICI Americas Inc., Wilmington, Del.
Tween 80—nonionic surfactant (polysorbate 80) available from ICI Americas Inc., Wilmington, Del.

Solvents

Isopar M—an aliphatic hydrocarbon available from Exxon Chemical Co., Houston, Tex.
Norpar 15—a normal paraffin available from Exxon Chemical Co., Houston, Tex.
Heptane—available from Aldrich Chemical Co, Milwaukee, Wis.
Isopropanol—available from Aldrich Chemical Co, Milwaukee, Wis.
Propylene carbonate—available from Arco Chemical Co., Newton Square, Penn., under the trade designation Arconate HP.
Tripropylene glycol methyl ether available from Dow Chemical Co., Midland, Mich.
Tripropylene glycol-n-butyl ether available from Dow Chemical Co., Midland, Mich.
Ethylene glycol phenyl ether available from Dow Chemical Co., Midland, Mich.
D. Limonene—a terpene available from SCM Glidden Organics, Jacksonville, Fla.
Exxsol D-110—an aliphatic hydrocarbon available from Exxon Chemical Co., Houston, Tex.
Exxate 1300—C₁₃ alkyl acetate available from Exxon Chemical Co., Houston, Tex.
Glycerol—available from J. T. Baker Chemical Co, Phillipsburg, N.J.
Thickener
Methocel 311—hydroxypropyl methylcellulose available from Dow Chemical Co., Midland, Mich.

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EXAMPLES

The invention is illustrated by the following examples which present various embodiments of the invention. In general, the joint compounds were prepared by: (1) mixing the water and thickener, if any, with the binder; (2) adding the dust reducing additive; and (3) adding the fillers, mixing continuously. If the formulation contained a dust reducing additive in the form of an oil and a surfactant, the surfactant was typically added before the oil. More specific procedures used to prepare certain joint compound formulations are described more fully below.

Table 2 presents the test results for a control joint compound formulation which did not contain a dust reducing additive, along with the formulation and test results for Examples 1-3, each of which contained a dust reducing additive in the form of a wax. Each formulation is presented by wet weight percent of each ingredient, that is, including water.

TABLE 2

WAXES				
Formulations by Wet Weight Percent				
Ingredient	Control	1	2	3
Calcium carbonate	64.3	61.24	44.0	63.34
Mica		2.7		
Kaolin	1.0	2.1		1.04
Glass Bubbles	4.7		6.0	1.73
Rhoplex AC 417 M	10.1	9.8	17.0	
Airflex RP-226				5.23
Triton X-405		0.13	0.2	0.16
Stearic Acid			0.75	
28% Ammonium Hydroxide			0.38	
Water	19.9	16.9	24.17	24.87
Octowax 321		7.13		
Boler 1070			7.5	
Carbowax 540				3.63
Airborne Dust	72 mg/m ³	28 mg/m ³	3.5 mg/m ³	5 mg/m ³
Drying Time	1 day	1 day	1 day	1 day

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The control formulation included a binder (Rhoplex AC 417 M), fillers (calcium carbonate, kaolin, and glass bubbles), and water. After being allowed to dry for one day, the specimen having the control formulation was sanded and found to produce a peak quantity of airborne dust particles having a size of less than or equal to 10 microns of 72 mg/m³. In Example 1, the formulation includes approximately 7% by weight wax (Octowax 321) which reduced the quantity of airborne dust to 28 mg/m³. In Example 2, the secondary fillers mica and kaolin have been replaced by glass bubbles, and a paraffin wax (Boler 321) was added. The quantity of dust generated by the resulting formulation was reduced to 3.5 mg/m³.

The formulation of Example 2 was prepared by combining the wax and stearic acid and heating them to 170° F. until a clear liquid was formed. Approximately half of the water was then heated to 170° F. and added to the ammonium hydroxide. The wax-stearic acid mixture was then combined with the water-ammonium hydroxide mixture, and this mixture was cooled to room temperature while mixing continuously. In turn, the Rhoplex AC 417M, the Triton X-405, the remaining quantity of water, the calcium carbonate, and the glass bubbles were added and mixed to produce a uniform mixture.

The joint compound formulation in Example 3 contains a vinyl acetate binder (Airflex RP-226) and a wax (Carbowax 540—polyethylene glycol). This joint compound formulation exhibited a dust level of 5 mg/m³. Carbowax is synthetic wax which is soluble or miscible in water. While paraffins and Carbowax are both considered waxes, they are believed to represent dissimilar waxes.

Table 3A presents the formulations and test results for Examples 4-9, each of which contains one oil and a surfactant which serve to suppress the formation of airborne dust particles during sanding.

TABLE 3A

OILS						
Formulations by Wet Weight Percent						
Ingredient	4	5	6	7	8	9
Calcium Carbonate	54.94	54.72	54.72	55.15	56.41	56.6
Glass Bubbles	8.9	10.8	10.8	8.55	8.25	6.32
Rhoplex AC 417M	15.63	15.57	15.57	15.69	25.77	26.31
Triton X-405	0.39	0.39	0.39	0.39	0.21	0.21
Water	15.5	15.44	15.44	15.56	6.19	6.32
Corn oil	4.64					
Linoleic acid		3.08	3.08			
Castor oil				4.66		
Mineral oil					3.17	
Tung oil						4.24
Airborne Dust	2.3 mg/m ³	3.5 mg/m ³	45 mg/m ³	2.5 mg/m ³	7 mg/m ³	13 mg/m ³
Drying Time	1 day	1 day	30 days	2 days	1 day	2 days

In each example, the oil significantly reduced the quantity of airborne particles produced during sanding. It will be noted that Examples 5 and 6 had similar formulations. In Example 5, however, the specimen was permitted to dry for only 1 day and in Example 6, the specimen was permitted to dry for 30

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days. By increasing the drying time from 1 day to 30 days, the quantity of airborne dust generated having a size less than or equal to 10 microns increased from 3.5 to 45 mg/m³. It has generally been observed that unsaturated oils, such as unsaturated vegetable oils and linoleic acid, reduce the quantity of airborne particles generated after a short drying time (e.g. 1 day) without significantly affecting the adhesive properties of the joint compound. In addition, the joint compound can be sanded quite easily. After an extended drying time (e.g. 30 days), however, it has been observed that the joint compound becomes more difficult to sand and the quantity of airborne dust particles increases.

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As shown in Example 8, mineral oil by itself was also found to significantly reduce airborne dust levels after a short drying time. In addition, mineral oil has been found to reduce airborne dust levels over an extended period of time. Mineral oil, however, was found to adversely affect the adhesive properties of the joint compound.

Table 3B presents the formulations and test results for Examples 10-15, each of which includes a dust reducing additive comprising a mixture of corn oil and mineral oil, and a surfactant. In each Example, the mineral oil and corn oil were premixed.

TABLE 3B

OIL MIXTURES						
Formulations by Wet Weight Percent						
Ingredient	10	11	12	13	14	15
Calcium Carbonate	68.65	63.69	63.69	58.07	61.05	61.05
Glass Bubbles		4.8	4.8	5.0	5.25	5.25
Mica	3.0					
Kaolin	2.4	0.99	0.99		3.0	3.0
Rhoplex AC 417M	11.0	9.9	9.9			
Rhoplex HG 74M				15.13	11.0	11.0
Triton X-405	0.15	0.15	0.15			
Variquat B-200					0.20	
Steol KS-460						0.20
FC 430				0.15		
Methocel 311				0.14		
Water	11.3	15.5	15.5	18.01	17.0	17.0
Corn oil	0.5	0.99	0.99	0.5	0.5	0.5
Mineral oil	3.0	3.98	3.98	3.0	2.0	2.0
Airborne Dust	5 mg/m ³	1.5 mg/m ³	5.5 mg/m ³	2.5 mg/m ³	10 mg/m ³	7 mg/m ³
Drying Time	1 day	1 day	19 days	4 days	4 days	4 days

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The combination of mineral oil and an unsaturated oil, such as linoleic acid or corn oil which contains some linoleic acid, was found to be a low dust additive that did not significantly adversely affect the adhesive properties of the joint compound and also reduced airborne dust levels over an extended period of time.

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Examples 11 and 12 have similar formulations but in Example 12, the drying time was increased to 19 days. As shown, the quantity of dust generated after 19 days increased only slightly. Thus, the dust reducing capability of the corn oil-mineral oil mixture remained much more stable over time than the formulations including linoleic acid presented in Examples 5 and 6.

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Example 13 shows that significant dust reduction is also achieved when using a combination additive of corn oil and mineral oil in a joint compound that contains a thickener (i.e. Methocel 311). Example 13 was prepared by premixing the Methocel 311 with the water until a clear liquid was formed. The surfactant FC 430 and resin Rhoplex HG 74M were then added. Next, the mineral oil and corn oil were premixed and added to the other ingredients, mixing continuously. The calcium carbonate and glass bubbles were then added.

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The formulations of the joint compounds in Examples 14 and 15 were similar but Example 14 included a cationic surfactant (Variquat B-200) and Example 15 included an anionic surfactant (Steol KS-460). In both examples, the mixture of corn oil and mineral oil together with the surfactant significantly reduced the quantity of airborne dust generated.

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Tables 4A and 4B present the formulations and test results for Examples 16-28. These examples demonstrate the dust reducing effect of various solvents.

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TABLE 4A

SOLVENTS						
Formulation by Wet Weight Percent						
Ingredient	16	17	18	19	20	21
Calcium Carbonate	61.18	69.69	63.12	60.18	48.90	60.49
Glass Bubbles	3.81	2.97	3.62	3.91	7.96	6.03
Kaolin						1.0
Rhoplex AC 417	13.09	10.22	12.44	13.43	30.8	
Rhoplex HG 74M						12.0
Triton X-405	0.24	0.19	0.22	0.25		0.15
FC 430					0.12	
Water	18.02	14.07	17.12	18.48	7.7	16.86
Propylene carbonate	3.66					
Tripropylene glycol methyl ether		2.86				
Tripropylene glycol-n butyl ether			3.48			
Ethylene glycol phenyl ether				3.75		
D. limonene					4.52	
Glycerol						3.47
Airborne Dust	14 mg/m ³	7.5 mg/m ³	3.5 mg/m ³	4.5 mg/m ³	5.5 mg/m ³	19.5 mg/m ³
Drying Time	2 days	3 days	2 days	2 days	1 day	1 day

TABLE 4B

SOLVENTS							
Formulations by Wet Weight Percent							
Ingredient	22	23	24	25	26	27	28
Calcium carbonate	69.95	69.95	68.31	68.31	70.69	68.65	69.95
Mica	3.0	3.0				3.0	3.0
Kaolin	2.4	2.4				2.4	2.4
Glass Bubbles			3.1	3.1	2.86		
Rhoplex AC 417 M	7.0	7.0	10.6	10.6	9.82	11.0	7.0
Triton X-405	0.15	0.15	0.19	0.19	0.18	0.15	0.15
Water	14.0	14.0	14.6	14.6	13.5	11.3	14.0
Heptane	3.5						
Isopropanol		3.5					
Isopar M			3.2	3.2			
Norpar 15					2.95		
Exxsol D-110						3.5	
Exxate 1300							3.5
Airborne Dust	105 mg/m ³	160 mg/m ³	7.5 mg/m ³	110 mg/m ³	27 mg/m ³	15 mg/m ³	12.8 mg/m ³
Drying Time	1 day	1 day	1 day	5 days	5 days	1 day	1 day

As shown in Examples 22 and 23, not all solvents are effective at reducing the quantity of airborne dust. In addition, Examples 24 and 25 demonstrate that an additive may be effective at reducing the quantity of dust generated for a given period of time, but that the level of dust will increase over time as the additive evaporates. Such a formulation may be desirable since the additive, depending on its volatility, can provide dust reduction for a predetermined period of time but will dissipate from the joint compound, thereby leaving a joint compound having properties similar to joint compounds without any dust reducing additive.

Table 5 presents the test results for Examples 29-33 which show the level of airborne dust generated by formulations containing different surfactants.

TABLE 5

SURFACTANTS					
Formulations by Wet Weight Percent					
Ingredient	29	30	31	32	33
Calcium Carbonate	63.91	61.05	61.05	62.98	62.57

TABLE 5-continued

SURFACTANTS					
Formulations by Wet Weight Percent					
Ingredient	29	30	31	32	33
Kaolin		3.0	3.0	1.03	1.03
Glass Bubbles	5.01	5.25	5.25	4.02	4.61
Rhoplex HG 74M	11.03	11.0	11.0	11.35	11.28
Water	17.04	17.0	17.0	17.53	17.43
Triton X-405	3.01				
Variquat B-200		2.7			
Stool			2.7		
KS-460				3.09	
Span 85					3.08
Tween 80					
Airborne Dust	65 mg/m ³	63 mg/m ³	42 mg/m ³	10 mg/m ³	8.5 mg/m ³
Drying Time	1 day	4 days	4 days	5 days	5 days

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It will be noted that in Examples 29-33, the percentage of surfactant added to the joint compound formulations was significantly greater than the quantity used to emulsify the oil in Examples 4-15 which ranged from 0.15 to 0.39 percent by weight. In Example 29, the nonionic surfactant Triton X-405 was found to only slightly reduce the quantity of airborne dust compared to the control formulation. Similarly, in Example 30, the cationic surfactant Variquat B-200 was found to slightly reduce the quantity of airborne dust. In Example 31, the anionic surfactant Steol KS-460 was found to moderately reduce the quantity of airborne dust. It was noted that each of the surfactants in Examples 29-31 was initially solid materials which had to be solubilized in water.

In Examples 32 and 33, the surfactants were liquids which did not dry easily. In Example 32, the nonionic surfactant Span 85, which is insoluble in water and has an HLB of 1.8, was found to have a significant dust reducing effect. In Example 33, Tween 80, which is soluble in water and has an HLB of 15, was found to have a significant dust reducing effect. It was therefore observed from Examples 32 and 33 that liquid surfactants which do not dry quickly may themselves serve as effective dust reducing additives.

Table 6A presents the formulations and test results of Examples 34-36 which show the effect that different resins had on dust generation.

TABLE 6A

DIFFERENT RESINS			
Ingredient	Formulations by Wet Weight Percent		
	34	35	36
Calcium Carbonate	63.45	64.05	62.23
Kaolin	1.0	1.0	2.91
Glass Bubbles	5.5	4.9	5.10
Triton X-405	0.45	0.15	0.15
Water	19.6	19.8	16.5
Rhoplex AC 417M	10.0		
Rhoplex HG 74M		10.1	10.68
Corn oil			0.49
Mineral oil			1.94
Airborne Dust	51 mg/m ³	81 mg/m ³	7 mg/m ³
Drying Time	1 day	1 day	1 day

Examples 34 and 35 show that Rhoplex AC 417M, a softer resin than Rhoplex HG 74M, may slightly reduce the level of airborne dust. In Example 36, when a dust reducing additive in the form of a corn oil mineral oil mixture was added, the level of dust generated was reduced significantly.

Table 6B presents the formulations and test results for Examples 37-39 which contained a high level of resin.

TABLE 6B

HIGH RESIN LEVELS			
Ingredient	Formulations by Wet Weight Percent		
	37	38	39
Calcium Carbonate	58.29	61.02	59.61
Kaolin	0.96	1.01	1.02
Glass Bubbles	5.6	1.11	3.41
Triton X-405	0.15	0.16	0.15
Rhoplex HG 74M	35.0		
Rhoplex 2620		36.7	
Rhoplex EC-2848			35.81
Airborne Dust	30 mg/m ³	6 mg/m ³ *	6.5 mg/m ³ *
Drying Time	1 day	1 day	1 day

*test discontinued prior to complete sanding of specimen

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In each formulation, the quantity of resin was at least 35% by weight. While each of the resins included approximately 50% by weight water, it will be noted that no additional water was added to any of the joint compound formulations. Rhoplex HG 74M is a harder resin than Rhoplex 2620 and EC-2848. The quantity of airborne dust generated for the formulations in Examples 37-39 was found to be less than the quantity of airborne dust generated by the control joint compound formulation in Table 2, but the formulations in Examples 37-39 were found to have objectionable sanding properties. During the testing of the specimens of Examples 38 and 39, only half of the specimen could be sanded due to the rubbery nature of the joint compound.

Table 6C presents the formulations and test results for joint compounds containing a vinyl acetate binder (Airflex RP-226). The control formulation contains a small quantity of surfactant which may serve to slightly reduce dust generation but is otherwise free of a dust reducing additive. Example 40 contains a dust reducing additive in the form of a mixture of corn oil and mineral oil which was found to significantly reduce the quantity of dust generated.

TABLE 6C

VINYL ACETATE BINDER		
Ingredient	Formulations by Wet Weight Percent	
	Control	40
Calcium Carbonate	63.01	62.87
Kaolin	1.03	1.03
Glass Bubbles	2.07	2.45
Triton X-405	0.15	0.15
Water	28.54	24.7
Airflex RP-226	5.2	5.19
Corn Oil		0.52
Mineral Oil		3.09
Airborne Dust	84 mg/m ³	3 mg/m ³
Drying Time	1 day	1 day

Table 7 presents the results for tests conducted by applying the dust reducing additive as a coating to a fully hardened joint compound. In each test, a specimen formed of Light Weight All Purpose Joint Compound available from United States Gypsum Co., Chicago, Ill. was prepared and allowed to harden for 4 days. The hardened joint compound was then saturated with the dust reducing additive and allowed to dry for an additional period of time, either 7 hours or 24 hours. The specimens were then sanded. It was found that when applied as a coating, the dust reducing additive served to significantly reduce the quantity of airborne dust particles generated by the joint compound.

TABLE 7

DUST REDUCING ADDITIVE APPLIED AS A COATING		
	Exxsol D 110	Isopar M
Airborne Dust (Dried 7 hours)	4 mg/m ³	7.5 mg/m ³
Airborne Dust (Dried 24 hours)	4 mg/m ³	27 mg/m ³

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Table 8 presents the formulations and test results for joint compound formulations containing a calcium sulfate dihydrate filler material. In Example 41, a significant reduction in airborne dust generation was achieved by including a dust reducing additive comprising a mixture of surfactant, corn oil, and mineral oil in the joint compound.

TABLE 8

CALCIUM SULFATE DIHYDRATE FILLER		
Ingredient	Formulations by Wet Weight Percent	
	Control	41
Calcium Sulfate Dihydrate	70.36	66.6
Rhoplex HG 74M	8.64	9.7
Water	21	19.3
Triton X-405		0.2
Corn oil		0.7
Mineral oil		3.5
Airborne Dust	225 mg/m ³	20 mg/m ³
Drying Time	1 day	1 day

Table 9 presents test results obtained using several commercially available joint compounds.

TABLE 9

CONVENTIONAL JOINT COMPOUNDS - NO ADDITIVE		
Conventional Joint Compound	Airborne Dust	Drying Time
All Purpose Joint Compound	100 mg/m ³	3 days
Light weight All Purpose Joint Compound	155 mg/m ³	3 days
Gold Bond Pro Form Prof. Lite Joint Compound	90 mg/m ³	4 days
Easy Sand 90 Setting Joint Compound	280 mg/m ³	3 days

The first three joint compounds are ready-mixed type joint compounds manufactured and marketed by United States Gypsum Co., Chicago, Ill., and Easy Sand 90 is a setting type joint compound manufactured by National Gypsum Co., Charlotte, N.C.

Table 10 shows the effect of adding a dust reducing additive to the conventional joint compounds of Table 9.

TABLE 10

CONVENTIONAL JOINT COMPOUND WITH ADDITIVE				
Ingredient	Formulations by Wet Weight Percent			
	All Purpose Joint Compound	Light weight All Purpose Joint Compound	Gold Bond Pro Formula Professional Lite Joint Compound	Easy Sand 90 Setting Joint Compound
Joint Compound	96.35	96.35	96.35	67.74
Corn oil	0.5	0.5	0.5	0.51
Mineral oil	3.0	3.0	3.0	4.1
Triton X-405	0.15	0.15	0.15	0.15
Water				27.5
Airborne Dust	2 mg/m ³	12 mg/m ³	5 mg/m ³	13 mg/m ³
Drying Time	3 days	1 day	1 day	2 days

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In each case, a premixed dust reducing additive including corn oil, mineral oil, and the surfactant Triton X-405 was added to each of the conventional joint compounds just prior to preparing the specimens, thereby serving to significantly reduce the quantity of airborne dust generated by sanding the hardened joint compound.

Table 11 presents the results obtained when a conventional spackling compound, also referred to as a wall repair compound, was tested.

TABLE 11

SPACKLING COMPOUND		
	Control	
		42
Spakfast	100	95.35
Corn oil		0.5
Mineral oil		4.0
Triton X-405		0.15
Airborne Dust	11 mg/m ³	3 mg/m ³

Spakfast is a wall repair compound available from Minnesota Mining and Manufacturing Company, St. Paul, Minn. Spakfast contains a high level of resin and exhibits a relatively low level of airborne dust. The level of airborne dust generated, however, was found to be significantly reduced when a dust reducing additive including corn oil, mineral oil, and a surfactant was added to the Spakfast formulation. Thus, according to the present invention, a dust reducing additive can be added to a conventional spackling compound to significantly reduce the quantity of airborne dust generated by the spackling compound.

While the formulations of each example has been presented in terms of the weight percent of each ingredient, it will be recognized that the formulations can also be presented in terms of the volume percent of each ingredient. By way of example, Table 12 presents two representative formulations in terms of both percent by weight and percent by volume.

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TABLE 12

FORMULATION IN WEIGHT VOLUME PERCENT				
Ingredient	Formulation 1		Formulation 2	
	% by Wt	% by Vol	% by Wt	% by Vol
Calcium Carbonate	62.23	25.66	54.73	14.82
Glass Bubbles	5.10	40.55	10.8	59.12
Kaolin	2.91	1.47	1	0.34
Rhoplex HG 74P	10.68	10.8	15.57	11.69
Triton X-405	0.15	0.15	0.15	0.11
Water	16.5	18.37	15.25	11.68
Corn oil	0.49	0.60	0.5	0.42
Mineral oil	1.94	2.40	2	1.82

Since glass bubbles have a low density and calcium carbonate has a high density, the percentage of glass bubbles increases significantly while the percentage of calcium carbonate decreases significantly when converting the formulation from one based on weight to one based on volume.

The patents, patent documents, and patent applications cited herein are incorporated by reference in their entirety as if each were individually incorporated by reference. It will be apparent to those of ordinary skill in the art that various changes and modifications may be made without deviating from the inventive concept set forth above. Thus, the scope of the present invention should not be limited to the structures described in this application, but only by the structures described by the language of the claims and the equivalents of those structures.

What is claimed is:

1. A joint compound composition comprising a filler, a binder, a thickener and one or more synthetic polymeric waxes, wherein each of said one or more waxes is at least slightly soluble in water and forms a solid at room temperature.

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2. The composition of claim 1 wherein said binder comprises a latex binder.

3. The composition of claim 1 wherein said filler comprises at least one of calcium carbonate, calcium sulfate dihydrate or calcium sulfate hemihydrate.

4. The composition of claim 1 wherein at least one of said synthetic waxes comprises polyethylene glycol.

5. A method of finishing a joint between adjacent gypsum board panels comprising applying a composition to said joint, said composition comprising water, a filler, a binder, a thickener and at one or more synthetic polymeric waxes, each of which is at least slightly soluble in water and forms a solid at room temperature.

6. The method of claim 5 further comprising taping said joint.

7. The method of claim 5 further comprising allowing said composition to dry and sanding said joint.

8. A joint compound composition as defined in claim 1, wherein the wax comprises from about 1.5% to about 6% of the joint compound total wet weight.

9. A joint compound composition as defined in claim 1, wherein the filler comprises from about 25% to about 95% of the joint compound total wet weight.

10. A joint compound composition as defined in claim 1, wherein the binder is selected from the group consisting of acrylic resins and vinyl acetate copolymers.

11. A joint compound composition as defined in claim 1, wherein the binder comprises from about 1% to about 45% of the joint compound total wet weight.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,052,544 B2
APPLICATION NO. : 11/029759
DATED : May 30, 2006
INVENTOR(S) : Langford, Nathaniel P.

Page 1 of 1

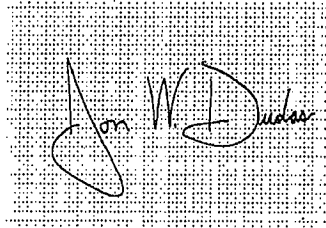
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 5 – Line 50 - Delete “thereof” and insert -- thereof. --, therefor.

Column 13-14 (Table 4A) – Line Col. 6 Line 18 - After “4.5 mg/m³” delete
“5 5 mg/m³” and insert -- 5 mg/m³ --, therefor.

Signed and Sealed this

Twelfth Day of September, 2006

A handwritten signature in black ink, appearing to read "Jon W. Dudas", is written over a rectangular area of fine grey dots.

JON W. DUDAS
Director of the United States Patent and Trademark Office

EXHIBIT B

CONFIDENTIAL DISCLOSURE AGREEMENT

In order to protect certain confidential information which may be disclosed between them, Minnesota Mining and Manufacturing Company, and 3M Innovative Properties Company ("3M") and the "Participant" identified below, intending to be legally bound, agree that:

1. The Discloser(s) of confidential information are both parties.
2. The parties' primary contacts for disclosing or receiving confidential information are:

3M: Gregg Hietpas
Nathaniel Langford

Participant: Robert Waterhouse

3. The confidential information ("Information") disclosed under this Agreement is described as: business and technical information relating to a low-dust drywall compound, and possible licensing of the same by 3M to USG.

4. This Agreement controls only Information which is disclosed to a party ("Recipient") during the period between the Effective Date and one (1) year thereafter. However, either party may terminate this period earlier by prior written notice to the other party.

5. Recipient shall use the Information only for the purpose of working with the other party in connection with possible licensing of the technology.

6. Recipient's duties under this Agreement expire three (3) years after the effective date.

7. Recipient shall not disclose Information to a third party without express written permission from Discloser. Recipient shall protect the disclosed Information by using the same degree of care, but no less than a reasonable degree of care, to prevent the unauthorized disclosure of the Information, as Recipient uses to protect its own confidential information of a like nature.

8. If Recipient is required by judicial or administrative process to disclose Information, Recipient shall promptly notify Discloser and allow Discloser a reasonable time to oppose such process.

9. Recipient's duties under this Agreement shall apply only to Information that is (a) disclosed by Discloser in writing and is marked at the time of disclosure to indicate it is confidential; (b) disclosed by Discloser in any other manner and is indicated at the time of disclosure to be confidential and thereafter is also summarized and designated as confidential in a written memorandum delivered to Recipient within one month of the disclosure; or (c) disclosed in the form of tangible materials

Effective Date: February 1, 2001

transmitted to Recipient with an accompanying written memorandum indicating the confidential nature of the materials.

10. Recipient of tangible materials constituting Information agrees not to analyze for composition or structure any such materials without the written consent of Discloser.

11. This agreement imposes no obligation upon Recipient with respect to Information that Recipient can establish (a) was in Recipient's possession before receipt from Discloser; (b) is or becomes available to the public through no fault of Recipient; (c) is received in good faith by Recipient from a third party and is not subject to an obligation of confidentiality owed to the third party; or (d) is independently developed by Recipient without reference to Information received hereunder.

12. Recipient agrees to return all extant Information (including tangible materials) received from Discloser upon request of Discloser except that Recipient may retain in the office of its legal counsel one copy of written Information for record purposes only.

13. Each Discloser warrants that it has the right to make disclosures under this Agreement.

14. Recipient shall adhere to the U.S. Export Administration Laws and Regulations and shall not export or re-export any technical data or products received from the Discloser or the direct product of such technical data to any proscribed country listed in the U.S. Export Administration Regulations unless properly authorized by the U.S. Government.

15. With the exception of the last sentence of Paragraph 4, all additions or modifications to this Agreement must be made in writing and executed by both parties.

16. The relationship created under this Agreement is confidential and is to be treated as Information according to the terms of this Agreement.

17. Under this Agreement neither party (a) acquires any license under intellectual property rights of the other party; (b) has an obligation to purchase from or sell to the other party any service or item; or (c) creates any agency or partnership relationship.

18. This Agreement is being executed in duplicate. Please return one fully executed copy to Office of Intellectual Property Counsel, 3M Innovative Properties Company, P.O. Box 33427, St. Paul, MN 55133-3427, Attention: David B. Patchett.

19. Attachment ☒ No ☐ Yes, number of pages _____

Participant	
Company Name	USG
Address	125 South Franklin
City-State-Zip Code	Chicago, IL 60606
Authorized Signature	
Printed Name	Edward M. Bosowski
Printed Name	Edward M. Bosowski
Title	President

Minnesota Mining and Manufacturing Company and 3M Innovative Properties Company (3M)	
Division Name	CHIM
Address	P.O. Box 33427, St. Paul, MN 55133-3427
Authorized Signature	
Printed Name	Kirk C. Graves
Title	Division Vice President
Approved by Office of Intellectual Property Counsel David B. Patchett	

EXHIBIT C

Effective Date: January 1, 2006

CONFIDENTIAL DISCLOSURE AGREEMENT

WHEREAS United States Patent 6,673,144 has issued to United States Gypsum Company (hereinafter "USG") concerning a low dust joint compound; and

WHEREAS United States Patent 7,052,544 has issued to 3M Innovative Properties Company (hereinafter referred to collectively with 3M Company as "3M") concerning a low dust wall repair compound; and

WHEREAS USG and 3M wish to confer regarding the subject matter of the USG patent and the 3M patent and other confidential proprietary information owned by USG and/or 3M; and

WHEREAS during the course of conducting the desired discussion, the parties and/or their employees may become aware of confidential information proprietary to USG and/or 3M;

NOW, THEREFORE, in consideration of these premises, and the mutual promises contained herein, USG and 3M agree as follows:

1. Any Party to this Agreement may be a discloser ("Discloser") or a recipient ("Recipient") of confidential information.
2. The parties' primary contacts for disclosing or receiving confidential information will be designated by the parties.
3. The confidential information ("Information") that is the subject of this Agreement is described as:

3M's general business and financial information relating to low dust drywall joint compounds, and information relating to 3M's patent portfolio for low dust drywall joint compounds; and

USG's general business and financial information relating to low dust drywall joint compounds, and information relating to USG's patent portfolio for low dust drywall joint compounds.

The relationship created under this Agreement is confidential and is to be treated as Information according to the terms of this Agreement.

4. Recipient's duties under this Agreement shall apply only to Information that is (a) disclosed by Discloser in writing and is marked at the time of disclosure to indicate it is confidential; (b) disclosed by Discloser in any other manner and is indicated at the time of disclosure to be confidential and thereafter is also summarized and designated as confidential in a written memorandum delivered to Recipient within one month of the disclosure; or (c) disclosed in the

form of tangible materials transmitted to Recipient with an accompanying written memorandum indicating the confidential nature of the materials.

5. This Agreement imposes no obligation upon Recipient with respect to Information that Recipient can establish (a) was in Recipient's possession before receipt from Discloser; (b) is or becomes available to the public through no fault of Recipient; (c) is received in good faith by Recipient from a third party and is not subject to an obligation of confidentiality owed to the third party; or (d) is independently developed by Recipient without reference to Information received hereunder.

6. This Agreement only relates to Information that is disclosed to a Recipient during the period from the Effective Date to February 1, 2008. Any party to this Agreement may terminate this period earlier by prior written notice to the other party, provided that such termination does not change any obligation hereunder for Information previously disclosed under this Agreement.

7. Recipient's duties under this Agreement expire on February 1, 2016.

8. Recipient shall not disclose Information to a third party without express written authorization from Discloser. Recipient shall protect the disclosed Information by using the same degree of care, but no less than a reasonable degree of care, to prevent the unauthorized disclosure of the Information, as Recipient uses to protect its own confidential information of a like nature. Information shall be disclosed with appropriate restrictive legends, and only to personnel of the Recipient party with the necessary need-to-know. Information shall not be disclosed or used for purposes of manufacture or procurement of the product to which the information pertains.

9. If Recipient is required by judicial or administrative process to disclose Information, Recipient shall promptly notify Discloser and shall allow Discloser a reasonable time to oppose such process. Recipient shall only disclose such Information pursuant to an appropriate protective order that preserves the confidentiality of such Information unless otherwise required by such judicial or administrative process.

10. Recipient agrees to return, or at its election destroy, all existing Information (including tangible materials) received from Discloser upon request of Discloser, except that Recipient may retain in the office of its legal counsel one copy of written Information for record purposes only.

11. Each Discloser warrants that it has the right to make disclosures of Information as provided under this Agreement.

12. Except where prohibited by applicable law, the parties agree to adhere to the U.S. Export Administration Laws and Regulations and shall not export or re-export any technical data or products received from the Discloser or the direct product of such technical data to any proscribed country listed in the U.S. Export Administration Regulations unless properly authorized by the U.S. Government.

13. Except as otherwise provided herein, all additions or modifications to this Agreement must be made in writing and executed by all parties.


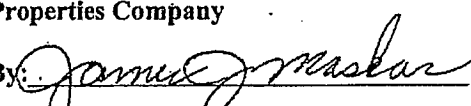
14. Under this Agreement, (a) no party acquires any license under intellectual property rights of the other party except the limited right to use Information as contemplated hereunder; (b) there is no obligation to purchase from or sell to the other party any service or item; and (c) no agency or partnership relationship is created between the parties.

15. The parties agree that this Agreement shall be construed, interpreted, governed, and applied in accordance with the laws of the State of Minnesota. The parties also agree that any dispute arising from the subject matter of this Agreement shall be brought solely and exclusively in the United States District Court for the District of Minnesota.

16. All communications between the parties, conduct, statements, and information exchanged between the parties pursuant to this Confidential Disclosure Agreement shall be deemed to fall within the scope and spirit of Federal Rule of Evidence 408 and shall not be admissible in any legal action between the parties. Such information shall not be inadmissible if otherwise discoverable without reference to the communications between the parties which occur pursuant to this Agreement.

This Agreement is entered into by and between the parties executing in triplicate and shall supersede and apply in lieu of any other previously executed agreement.

ACCEPTED:

United States Gypsum Company	3M Company and 3M Innovative Properties Company
By: <u></u>	By: <u></u>
Printed Name: <u>Michael M. Geoffrey</u>	Printed Name: <u>James J. Maskas</u>
Title: <u>Chief IP Counsel</u>	Title: <u>V.P. CHIm Div.</u>
Date: <u>2-5-2007</u>	Date: <u>2/14/07</u>